

Tribhuvan University
Bachelor of Science in Computer Science and Information Technology
Course Title: Introduction to Artificial Intelligence

Course No.: CSC 304

Full Marks: 60+20+20

Credit hours: 3

Pass Marks: 24+8+8

Nature of Course: Theory (3 Hrs.) + Lab (3 Hrs.)

Course Synopsis: This course introduces the problem solving techniques, problem representation & machine learning.

Goal: The main objective of the course is to provide basic knowledge of Artificial Intelligence with acquaintance of different search techniques and AI applications.

Course Contents:

Unit 1: Introduction to Artificial Intelligence

Artificial Intelligence and related fields, brief history of AI, applications of AI, Definition & importance of knowledge & learning, Agent & its type and performance measures.

Unit 2: Problem Solving

Problem definition, problem as a state space search, problem formulation, problem types: Tor problems, Real world problems, Well-defined problems, Constraint satisfaction problem (Basic concept & examples), Production systems (Definition, Architecture, examples).

Unit 3: Search Techniques

Uniformed search techniques: depth first search, breadth first search, depth limit search, Iterative deepening search, Bidirectional search, & search strategy comparison. Informed search techniques: Greedy best first search, A* search, Hill climbing search, Simulated annealing, Game playing, Adversarial search techniques-mini-max procedure, alpha beta pruning.

Unit 4: Knowledge Representation, Inferential reasoning

Formal logic connectives, truth table, syntax, semantics, tautology, validity, well-formed formula, propositional logic, Inference with PL: Resolution, Backward chaining & Forward chaining, predicate logic (FOPL), quantification, inference with FOPL by converting into PL (Existential & Universal instantiation), Directly with FOPL. (Unification & lifting, resolution, backward chaining, forward chaining), Rule based deduction system, Statistical reasoning-probability & Bayes theorem & causal networks, reasoning in belief network.

Unit 5: Structured Knowledge Representation

Representation and mappings, Approaches to knowledge representation, Issues in knowledge representation, Semantic nets, Frames, Conceptual dependencies and scripts (Rich and Knight).

Unit 6: Machine Learning

Concepts of learning, learning from examples, explanation based learning, learning by analogy, learning by simulating evolution, learning by training neural nets, learning by training perceptions.

Unit 7: Applications of Artificial Intelligence

Expert system (Architecture, Expert system development process), Neural Network (Mathematical model, get realization, Network structure), natural language processing (Steps of NLP parsing), Basic concepts of Machine vision.

Laboratory Work:

Laboratory exercises should be conducted in either LISP or PROLOG. Laboratory exercises must cover the fundamental search techniques, concept of knowledge representation.

Text/Reference Books:

- E. Rich and Knight, Artificial Intelligence, McGraw Hill.
- D.W. Patterson, Artificial Intelligence & Expert Systems, Printice Hall.
- P.H. Winston, Artificial Intelligence, Addison Wesley.
- Stuart Rusel and Peter Norvig, Artificial Intelligence A Modern Approaches, Pearson
- Ivan Bratko, PROLOG Programming for Artificial Intelligence.

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Model Question Paper

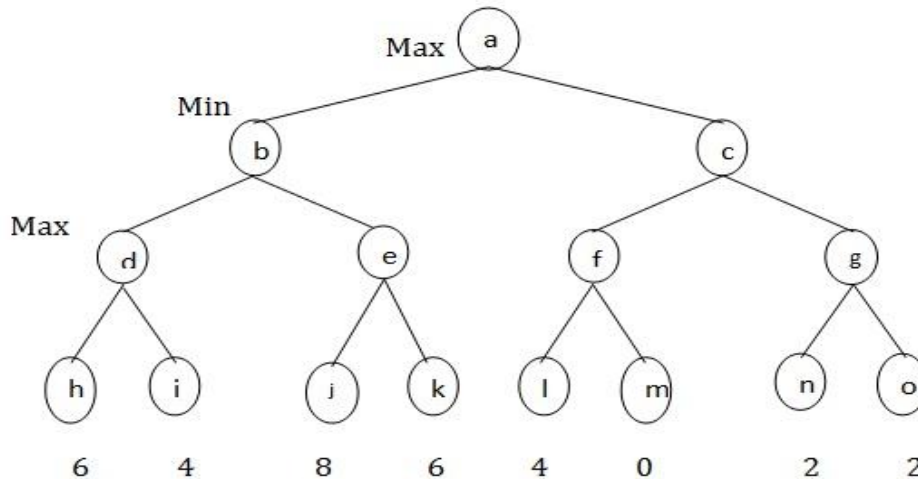
FM. = 60

Hr. = 3 Hrs.

PM. = 24

Introduction to Artificial Intelligence

1. Is it possible to make a computer that think like human brain until up to now? Justify with proper reason. What is the purpose of Turing test? Describe it in detail.
2. What is meant by admissible heuristic? Give example of admissible heuristic. What improvement is done in A* search than Greedy Search? Prove that A* search gives us optimal solution if the heuristic function is admissible.
3. What is the purpose of utility value in game search? Consider the following game tree (drawn from the point of view of the Maximizing player):



Use the mini-max procedures and show what moves should be chosen by the two players.

Use the alpha-beta pruning procedure and show what nodes would not need to be examined.

4. What is meant by complete and soundness property of inference algorithm? Consider the knowledge base given as below:

$$(P \Leftrightarrow (P \vee Q)) \wedge \neg P$$

Prove that $\neg Q$ can be inferred from above KB by using resolution.

5. What is standardizing apart? Convert the following statements into FOPL

All over smart persons are stupid

Children's of all stupid persons are naughty

Ram is children of Hari

Hari is over smart

Prove that Ram is naughty by using Backward Chaining

6. Describe role of domain expert, Knowledge engineer and programmer in SDLC of expert system. Explain the features of expert system.

7. What is the difference between symbolic and non-symbolic AI? Represent the following knowledge in semantic network

Robin is bird

Clyde is a Robin

Clyde owns a nest from spring 2010 to fall 2010

8. What is machine learning? Explain the learning from Analogy and Instance based learning.
9. What is Constraint satisfaction problem? Give an example of constraint satisfaction problem. Consider the following a production system characterized by
 - Initial short term memory: C5, C1, C3
 - Production rules:
 - $C1 \ \& \ C2 \rightarrow C4$
 - $C3 \rightarrow C2$
 - $C1 \ \& \ C3 \rightarrow C6$
 - $C4 \rightarrow C6$
 - $C5 \rightarrow C1$

Show a possible sequence of two recognize-art cycles. Which will be the new content of the short-term memory after these two cycles?

10. What is Bayesian network? Explain how Bayesian network represent and inference the uncertain knowledge.